# Effect of Educational Program on Outcomes of Patients Undergoing Permanent Pacemakers' Implantation

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## ABSTRACT

***Contents:*** Patients undergoing permanent implantable pacemaker, challenge with multiple physical, psychological along with social complications. Teaching patients the essential points involving pacemaker management can prevent complications.
***Aim:*** The current study aimed to evaluate the effect of an educational program on outcomes of patients undergoing permanent pacemakers' implantation.
***Methods:*** A quasi-experimental pre/posttest and follow-up design were used to conduct this study. A convenient sample of 35 adult patients from both genders undergoing permanent pacemaker implantation was recruited from Beni-Suef University hospital's catheter lab, inpatient department, ICU, CCU, and outpatient cardiology clinic. Patients' interviewing questionnaire, patient performance checklist, pacemaker self-efficacy scale, and Aga Khan University Anxiety and Depression Scale were used to achieve this study's aim.
***Results***: 91.4% of the studied patients had unsatisfactory total knowledge at the baseline, improved to 85.7% had a satisfactory knowledge immediately post educational intervention, and relatively maintained to 68.6% of them had a satisfactory level of total knowledge after four weeks of program implementation. 97.1% of the studied patients had unsatisfactory total practice at the baseline, improved to 65.7% had a satisfactory practice immediately post educational intervention, and improved to 77.1% of them had a satisfactory level of total practice after four weeks of program implementation. 71.4%, 85.7% of the studied patients were not confident at all with their ability to control symptoms and maintain their usual functions respectively before education. 91.4% of them reported a total low self-efficacy score before the educational intervention. In comparison, 45.7% were very confident in controlling symptoms and moderately confident in maintaining usual functions at the follow-up phase. Besides, 65.7 exhibited total high self-efficacy at the follow-up assessment. 57.1% of the studied patients exhibit severe anxiety at the baseline assessment, while 65.7% and 74.3% exhibit mild anxiety at the post and follow-up assessment.
***Conclusion***: A statistically significant improvement in patients' knowledge, practice, self-efficacy, anxiety, and depression immediately and after four weeks compared to their baseline. The study recommended that the educational program be an essential part of the total management of patients undergoing implanted pacemakers.

***Keywords:*** Educational program, permanent pacemaker, patient outcomes

## 1. Introduction

A cardiac pacemaker is an artificial apparatus that stimulates the myocardium electrically to depolarize, to begin a contraction when the heart's natural pacemaker does not work properly. Depending on the patient's condition, this system can be temporary or permanent *(Karen, 2019).* It is designated for conditions that result in the heart's failure to initiate or carry out an intrinsic electrical impulse at a rate adequate to maintain perfusion. Pacemakers are essential when dysrhythmias or conduction defects compromise the electrical system and the heart's hemodynamic response *(Carven & Hirnel, 2019).*

Every year 1-2 million individuals worldwide die due to a lack of pacemakers' access *(Robert, 2018).* Patients with implanted cardiac devices are a growing segment in modern health care practice. There are about 3 million people with pacemakers worldwide, and 600,000 pacemakers are implanted every year. It is a challenge for all health care providers working in a cardiology ward, operating room, or primary care practice to care for such an increasingly growing patient population *(Kanjilal et al., 2018; Bonke & Eby, 2017).*

Worldwide management of permanent pacemakers is a complicated challenge for cardiologists. The reported incidence of temporary pacemakers' complication rates ranges from 0.19% to 13.9% and 0.8% for permanent pacemakers, respectively. Patients with permanent pacemakers could be presented with a pulse-generator pocket infection, otherwise blood-stream infection *(Daniels et al., 2017).*

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Studies have shown that non-compliance effect 125,000 deaths annually in the USA, leads to 10% to 25% of hospital in addition to nursing home admissions and is becoming a widespread *(Daniels et al., 2017).* A permanent pacemaker can significantly improve quality of life, and for many people, it can be lifesaving. The best possible outcome after permanent pacemaker insertion can only be attained if patients are maintained in compliance with lifelong instructions *(Timby & Smith, 2019).*

Recovery from the operation is fast, but there might be some limits on arm movement and activities for the first two to four weeks. In the first few weeks following implantation, lead dislodgement is more frequent. Collapsed lung (pneumothorax), inflammation, perforation, tamponade, and bleeding are rare but still potential risks associated with permanent pacemaker implantation. Various devices, including those with a magnetic field and security equipment at the stations, can interfere with pacemakers. Several diagnostic methods can lead to heart rhythm disorders and reduce device longevity *(Mlynarski et al., 2009; Buellesfeld et al., 2012).*

Patients undergoing permanent implantable pacemakers were challenged with multiple physical, psychological, along social complications *(Chugh, 2018).* Patients who do not know about permanent pacemakers face significant serious problems that confronting healthcare nowadays *(Brenda, 2015).* The patients could perceive the pacemaker apparatus as electronic security otherwise as a physical plus emotional discomfort source. Introducing a foreign body into the heart can cause psychosocial adaptation problems and contribute to the emergence of affective disorders *(Vellone et al., 2008).* Several general psychological reactions that patients with an implanted pacemaker may experience are low moods, tearfulness, sleep disturbance, irritability, anxiety, depression, an acute awareness of minor somatic sensations or pain, and low concentration as well as memory *(Gillis et al., 2017; Gribbin et al., 2005).*

The problems can be prevented by educating patients on the critical points of pacemaker management. Patient education has been an essential part of the clinical approach to treating patients with a pacemaker. It is furthermore integral to the promotion of self-efficacy about the complicated treatment schedule. Also, patients' self-efficacy may direct them to the acceptance of pacemaker, adaptation with the device presence, and improvement of their quality of life *(Hossein et al., 2010; Kirkpatrick et al., 2015).*

Self-efficacy reflects the capability to organize and integrate cognitive, social, plus behavioral skills to meet various purposes. Coping with challenges posed by chronic disease necessitates knowledge and skills and confidence in one's ability to make practical use of those skills and confidence that using the skills can achieve the desired result *(Dougherty et al., 2007; Boldt, 2016).*

The educational program refers to face to face communication among care providers and clients to make free and informed choices about their lives and carry out their choices. Patients should be trained with the implicit expectation that the permanent pacemaker patient can process and appreciate the knowledge gathered to adapt his life with a device *(Angelidou, 2019).*

For nurses involved in their treatment, cardiac patients' training to lead an active life after a permanent pacemaker implant poses several challenges. In these patients, sufficient instructional materials given during both the inpatient and outpatient phases of treatment will encourage a positive attitude and independence. In their supervision of these patients' follow-up treatment, nurses are becoming increasingly autonomous. Guidelines for pacemaker function evaluation, malfunction detection, and reprogramming techniques are given *(Stewart & Sheehan, 1991).* Nursing management for pacemaker patients requires tracking and avoiding common complications, avoiding dislocation, and informing patients about the pacemaker's proper use and maintenance *(Matt, 2019).*

## 2. Significance of the Study

Patients experiencing pacemaker implantation were facing many challenges following operation due to lack of knowledge. Therefore, these patients experienced direct and indirect complications that could be attributed to the pacemaker implantation itself or dramatic changes in their lives: Physical and psychological disorders, defect of bodily function, change in personal hygiene, restrictions in social functioning, and sexual functioning impairment *(Gandhi et al., 2012; Buist & Volmer, 2019).*

Several Egyptian studies were conducted to guide the care provided for those patients. One study was conducted at Mansura University, Egypt, to assess the educational program's effectiveness on patients' knowledge and practice undergoing permanent pacemakers. The study evidenced a statistically significant improvement in knowledge and practice baseline, immediately, and after four weeks of program implementation *(Mohamed et al., 2009).* Another study was conducted at Ain Shams University; *El-Sayed et al. (2015)* conducted a study to evaluate the effect of self-care management guidelines on nursing-sensitive patient's outcomes after permanent pacemaker implantation. The study concluded that implementing self-care management guidelines positively enhancing all dimensions of nursing-sensitive patients' outcomes.

The revision of medical records and statistical data of Bani-suef University Hospital revealed that the percentages of patients admitted for pacemaker insertion were 7.59% in 2016, 8.52% in 2017, and 9.4% in 2018 *(Statistical Administration and Medical Records Department Bani-Suef University Hospital, 2017).* Furthermore, this research could help maintain cost-effective patient care, especially in critical care units and primary care facilities, as it might empower the patient, shorten hospital stay, and safeguard patients against any life-threatening complications. This effort could generate attention and motivation for further investigations into this area.

## 3. Aim of the study

The study aimed to evaluate the effect of an educational program on outcomes of patients undergoing permanent pacemakers' implantation.

This aim was achieved through the followings:
- Assessing patients' performance (knowledge, practice), self-efficacy, anxiety and depression after permanent pacemaker implantation.
- Developing and implementing the educational program for patients with permanent pacemaker implantation.
- Evaluating the educational program's effect on performance (knowledge, practice), self-efficacy, anxiety, and depression of patients undergoing permanent pacemaker implantation.

### 3.1. Operational definition

The outcomes intended in this study are the patients' knowledge, practice, self-efficacy, anxiety, and depression.

### 3.1. Hypotheses of the study

The following research hypotheses were formulated to accomplish the aim of the study:
- Post implementing the educational program, the patients' knowledge and practice score regarding permanently implanted pacemakers will be higher than their pre-implementation scores.
- Post implementing the educational program, patients' self-efficacy, anxiety, and depression will be improved than their pre-implementation level.

## 4.Subjects & Methods

### *4.1. Research design*

A quasi-experimental pre/post and follow up (after four weeks) test design was used to conduct this study. Quasi-experimental studies, therefore, are studies that imitate experimental testing but are not actual experimental studies. Although the independent variable is manipulated, conditions, or terms of conditions are not randomly allocated to participants *(Cook & Campbell, 1979).*

### *4.2. Research setting*

The present study was conducted in both catheter lab, inpatient department (ICU and CCU), Cardiology outpatient clinic affiliated to Beni-Suef University Hospital. The present study conducted in the main building of Beni-Suef University Hospital that consists of four floors, outpatient clinic of cardiology, is present on the first floor. The second floor involved inpatient departments (ICU, CCU, and intermediate room) and a catheterization lab.

### *4.3. Subjects*

A convenient sample of 35 adult patients from both genders who agreed to participate in the study and undergo permanent pacemaker implantation from the settings mentioned above was recruited within six months.

### *4.4. Tools of the study*

For this study, three instruments were used to collect data.

### 4.4.1. Patients' Interviewing Questionnaire

It was developed by the researcher based on reviewing recent and related literature *Dickerson, (2018).* It was anonymous, written in the English language, and translated to the Arabic language to fit the sample characteristics. It was reviewed by a panel of experts from Fayoum Nursing College and nursing supervisors from the selected CCU, ICU, cardiology outpatient, and catheterization room. It consisted of three parts.

Part 1: Demographic characteristics of the studied patients concerning age, gender, marital status, level of education, residence, living status, job, adequacy of monthly income, treatment affordability, and transportation cost.

Part 2: History of coexisting disease. It included co-morbid conditions such as associated cardiac disease other than conduction defects, hypertension, diabetes mellitus, kidney diseases, liver disease, and other chronic diseases. It had a combination of open and closed-ended questions.

Part 3: Patients' knowledge assessment sheet (pre/post tests and follow up after four weeks. The researchers develop it after reviewing related literature of *Tagney (2010); Kramer et al. (2015)*; *Olshansky & Hayes (2015).* It was used to assess patients' knowledge related to device description (3 questions), procedure preparation (5 questions), the implantation procedure (5 questions), post-procedure care (7 questions), pacemaker precautions (5 questions), instruction related to movement and activities of daily living (7 questions), medications (7 questions) and follow up (7 questions). It consists of 46 questions in multiple-choice form.

*Scoring system*

One point was given for each correct answer, and zero was given to the incorrect one with a maximum possible score of 46. The patients' score was presented as the median and range for each knowledge section. The total knowledge scores were summed and classified as two levels (satisfactory knowledge at ≥ 75%, and unsatisfactory at <75% of the total score).

### 4.4.2. Patient Performance Checklists

The researchers developed this tool to include assessment and evaluation of two critical assessment and caring procedures. The patient has to learn to follow the heart rate and rhythm and the wound healing process. It developed based on *Nasr et al. (2015).*

#### 4.4.2.1. Redial Pulse Measurement Checklist

The checklist was used to assess the patient's ability to measure the radial pulse. It consisted of 7 procedural steps.

#### 4.4.2.2. Wound Care Checklist

The checklist was designed to assess infection (redness, mal-odor, localized pain, localized heat, delaying, or abnormal healing) and wound care by using the sterile technique. It consisted of 11 procedural steps.

*Scoring system*

The responses were measured on a scale of done and not done in both checklists. As one for done correctly, and zero for not done. The patients' score was presented as the median and range. The total procedure score was then classified as

satisfactory and unsatisfactory (satisfactory practice at ≥75%, and unsatisfactory at <75% of the total score).

#### 4.4.3. Pacemaker Self-Efficacy Scale

It was adapted from *Sullivan et al. (2018); Margey et al. (2010)*; *Wenwen et al. (2013)* and modified by the researchers to go well with the aim of the current study. It was utilized to assess a general sense of perceived self-efficacy through daily hassles and the disease's consequences for patients with permanent pacemakers. It has 13 statements categorized under two main items.

They are control symptoms (8 statements). The symptoms assessed included dizziness, fainting, palpitation, trouble catching breath, and hiccups that last more than 15 minutes, chest pain, chills, and fever. The second main item is to maintain the usual functions (5 statements). Translation and retranslation from English to Arabic were used to ensure the accuracy of the tool's content. A three-point Likert scale was used to assess the patient self-efficacy responses pre/post and follow up after four weeks.

*Scoring system*

Patients were asked to rate their confidence with knowing or acting relating to the 13 statements as follows: Not at all confident (1 score), moderately confident (2 scores), and very confident (3 scores). Higher scores refer to higher self-efficacy. The total score equal to 39 scores, whereas scores less than 50% were considered low self-efficacy, and scores from 50% and more were considered high self-efficacy.

#### 4.4.4. Aga Khan University Anxiety and Depression Scale

It was adopted *by Reza et al. (1998).* The scale used in this study to detect anxiety and depression in a patient with permanent pacemakers. The scale comprises 25 questions; with 13 addressing psychological and 12 somatic symptoms such as "during the past two weeks have you been sleeping less, have you had lack of interest in your daily activities, have you preferred to be alone, have you cried and have you felt pain all over your body?" This scale used pre/post and after four weeks of program implementation.

*Scoring system*

Each item's score ranged from 1-3, where one refers to never, two refer to sometimes, and three refer to always. The total score ranged from 25-75 points, and it was categorized into a score from 25-41 (mild), score from 42-58 (moderate), and 59-75 (severe).

### *4.5. Procedures*

The study design includes the preparatory phase, validity, pilot study, and fieldwork, including data collection.

The preparatory phase included reviewing related literature and theoretical background of various aspects of the study using the book, articles, internet, periodicals to develop the theoretical part of the study and data collection tools. An official letter was issued from the Faculty of Nursing at Fayoum University, Egypt, and sent to the director of Bani-Suef University Hospital to get their permission for data collection from the authorized person. The letter clarified the study's aim and requested cooperation from them.

Content validity was determined by five experts from Medical-Surgical, Critical, Psychiatric Nursing, and Public Health Departments. Their opinions were elicited regarding the tool format layout, content, accuracy, relevance, completeness, and scoring system. The reliability of all study tools was tested using Cronbach's test. It ranged from 0.80 for the knowledge assessment questionnaire to 0.93 for the patient performance checklists and self-efficacy scale. Except for the Aga khan university anxiety and depression scale, it showed a correlation coefficient of 0.75.

Ethical considerations: Patients were briefed on the study's purpose and their right to cancel their participation at any time without any repercussions. The researchers assured maintaining anonymity and confidentiality of the subject's data; then, each agreed patient's written consent was obtained to participate in the study.

A pilot study was conducted on 10% (3 patients) of the total study sample to check the instruments' clarity and the feasibility of the research process. As there were no radical changes in the research instruments, pilot subjects were later included in the research.

Fieldwork: Sampling and data collection were started in August 2019 and completed within six months. The researchers were available at the work field to collect data for three days per week in the morning shift by rotation. The educational program was constructed in four phases:

Assessment phase: In the first interview, researchers introduced themselves to each participant. A full explanation of the study was done. The researchers collected the demographic data, and medical history, besides the baseline assessment of the patient's knowledge, practice, self-efficacy, anxiety, and depression symptoms (pretest). The educational program was designed based on the results of the baseline assessment.

Planning (preparatory) phase: The program content, educational booklet, and media (posters and visual materials) were prepared by the researchers for patients under the study based on their identified learning needs. This program was delivered using a diversity of teaching methods (lecture, discussion, demonstration and re-demonstration, case presentation for compliant patients, and brainstorming).

The implementation phase: The researchers conduct the educational program after finishing the pretest. The researchers have used the above-mentioned audiovisual aids, such as data show and pictures.

The researchers visited the catheterization lab, intermediate room, cardiac care unit (CCU), intensive care unit (ICU), and cardiology clinic affiliated to Beni-Suef University Hospital. The data collection process starting from 9.00 am to 2.00 pm for three days weekly to fill in the questionnaires in the morning shift by rotation. Each patient took about 45 minutes to fill in the questionnaires and for the researcher to observe the patient practicing the procedures.

The educational program covered six consecutive sessions before the pacemaker implantation, after one day of

implantation, and continued at the outpatient clinic after discharge. Four sessions covered the theoretical content, and the last two sessions were allocated for teaching the practical skills and answering the patient's concerns for future management. The researchers began by providing a description of the previous session at the beginning of each educational session and describing the new one's goal. Each session's duration ranged from 30-45 minutes, followed by 5-10 minutes for a summary and debriefing of what has been accomplished.

The educational program was covered the following topics: Device description (definition, function, parts, types, and sites of implantation of pacemaker), knowledge about preoperative preparation, implantation procedures, and postoperative instruction (including the signs symptoms of complications that might occur after pacemaker insertion and how to avoid/prevent them, and diet regimen). The program also included Pacemakers precautions, movement, and daily living activities (including safety progression inactivity and exercise cautions taken in travel and in dealing with electrical appliances). Medication and the importance of follow-up adherence were also discussed, including allowing patients to pinpoint specific concerns that would not ordinarily be identified, such as difficulties in sleeping, memory, sexual functioning, fear from device malfunction, questioning patients about personal concerns allows attaining needed information and chat about the device. The taught practical skills, including steps of radial pulse measurement and wound care, were demonstrated.

Evaluation phase: Evaluating the program's effect on the studied patients was started immediately after implementing the educational program. Each patient had been met several times; on admission, before insertion, immediately after insertion, before discharge, one week after discharge, one month after discharge. This schedule was designed to assess and follow the patient's progress, knowledge and practice acquired and complication occurrences. The presence of complications well was evaluated weekly after discharge, and during periods of follow-up, a comparison between the pre/post and follow-up tests was made.

### *4.6. Data analysis*

The Statistical Package for Social Science (SPSS) version 22 was applied for data analysis. Data were presented using numbers, percentages, median, and range. The chi-square statistic compares the sample size and the number of variables in the relationship, any inconsistencies between the expected results and the real results. The one-sample Z-test is used to test whether the mean of a population is more significant than, less than, or not equal to a specific value and r test for assessing the correlation between variables. The level of significance was thresholds at $p \leq 0.05$.

## 5. Results

Table 1 demonstrates that 45.7% of the studied patients' ages were between 40-<50, 60% were males. Most of them (71.4%) were married, and 51.4% had secondary education, 31.4% can just read and write. Concerning their living status, 88.6% of them live with their families, 71.4% were labor workers with inadequate income 74.3%, had health insurance 45.7% or ministerial decree 40%, and reporting high transportation costs 54.3%

Figure 1 shows that 17.1% had a history of cardiac diseases other than the conduction disturbances. Also, 11.4% of them had hypertension, and 8.6 % had diabetes mellitus, while 5.7%, 5.2% of them had kidney and liver diseases, respectively.

Table 2 demonstrates a statistically significant difference between patients' knowledge immediately and after four weeks compared to the baseline regarding device description, procedural preparation, implantation procedure, post-procedure care, pacemaker precautions, movement, and daily living activity, medication, and follow up at ($p<0.0001$).

Figure 2 elucidates the percentage distribution of the total knowledge score at the baseline, immediately and after four program implementation weeks. The figure shows that 91.4% of the studied patients had unsatisfactory total knowledge at the baseline, improved to 85.7% had a satisfactory knowledge immediately post-intervention, and relatively maintained to 68.6% of them had a satisfactory level of total knowledge four weeks of program implementation.

Table 3 shows a statistically significant difference between patients' practice immediately and after four weeks compared to the baseline regarding both critical procedures (measuring the radial pulse and wound care) at ($p<0.0001$).

Figure 3 clarifies the percentage distribution of the total practice score at the baseline, immediately and after four program implementation weeks. The figure shows that 97.1% of the studied patients had unsatisfactory total practice at the baseline, improved to 65.7% had a satisfactory practice immediately post educational program, and improved to 77.1% of them had a satisfactory total practice level after four weeks of program implementation.

Table 4 shows a statistically significant positive correlation between the studied patients' total knowledge and total practice score after four program implementation weeks ($p=0.004$).

Table 5 shows that 71.4%, 85.7% of the patients were not confident at all with their ability to control symptoms and maintain normal functions before education. 91.4% of them reported total low self-efficacy at the baseline assessment. In comparison, 45.7% were very confident in controlling symptoms and moderately confident in maintaining usual functions at the follow-up phase with a statistically significant difference between patients' self-efficacy pre, immediately, after four weeks of program implementation at ($p<0.0001$) regarding the two self-efficacy subscales of controlling symptoms and maintaining the usual functions, and the total self-efficacy score.

Table 6 shows that 57.1% of the studied patients exhibit severe anxiety and depression levels at the baseline assessment. In comparison, 65.7% and 74.3% exhibits mild anxiety and depression levels at the post and follow-up assessment with a highly statistically significant improvement immediately and at follow up phases of program implementation.

**Table (1): The frequency and percentage distribution of the studied sample sociodemographic characteristics.**

| Sociodemographic characteristics | No=35 | % |
|---|---|---|
| **Age in years** | | |
| 20-<30 | 1 | 2.9 |
| 30-<40 | 6 | 20 |
| 40-<50 | 16 | 45.7 |
| 50-≤60 | 12 | 34.3 |
| **Gender** | | |
| Male | 21 | 60 |
| Female | 14 | 40 |
| **Marital status.** | | |
| Married | 25 | 71.4 |
| Single | 4 | 11.4 |
| Widow | 7 | 20 |
| Divorced | 0 | 0 |
| **Level of education** | | |
| Illiterate | 2 | 5.7 |
| Read/write | 11 | 31.4 |
| Secondary education | 18 | 51.4 |
| High education | 5 | 14.3 |
| **Residence** | | |
| Rural | 22 | 62.9 |
| Urban | 13 | 37.1 |
| **Living status** | | |
| Alone | 4 | 11.4 |
| Live with family | 31 | 88.6 |
| Live with other | 1 | 2.9 |
| **Job** | | |
| Skilled work | 10 | 28.6 |
| Labor work | 25 | 71.4 |
| **Adequacy of monthly Income** | | |
| Adequate | 9 | 25.7 |
| Inadequate | 26 | 74.3 |
| **Treatment affordability** | | |
| Free | 1 | 2.9 |
| Health insurance | 16 | 45.7 |
| Ministerial decree | 14 | 40 |
| The own patient expense | 4 | 11.4 |
| **Transportation costs** | | |
| High | 19 | 54.3 |
| affordable | 16 | 45.3 |

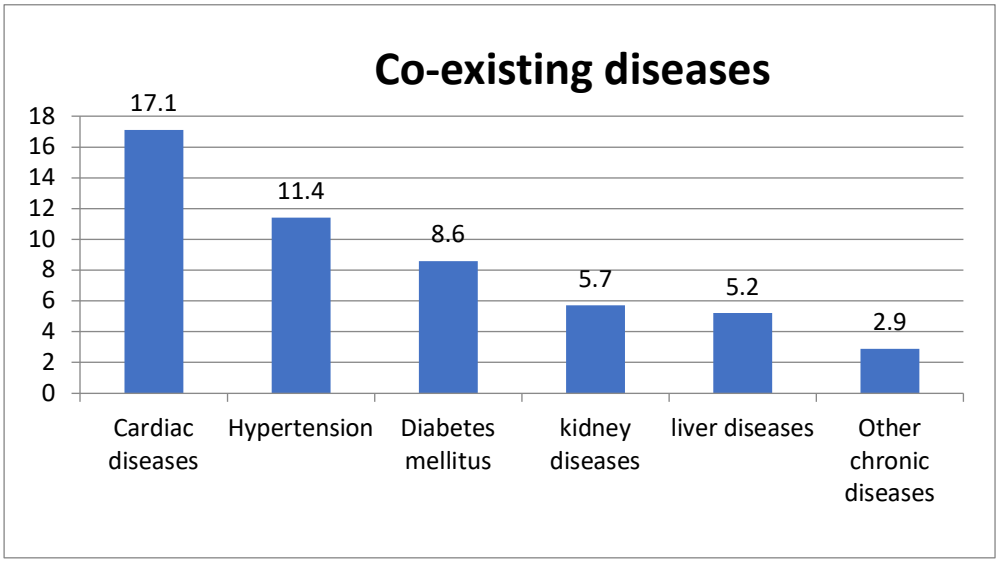


**Figure (1): Percentage distribution of the studied patients coexisting diseases (n =35).**

**Table 2: Comparison of patients' knowledge through the program implementation phases (no=35).**

| Parameters | Baseline Median (Min-Max) | Immediate Median (Min-Max) | Z* test$_1$ | $P_1$ | After 4weeks Median (Min-Max) | Z test$_2$ | $P_2$ |
|---|---|---|---|---|---|---|---|
| Device description | 0 (0-3) | 3 (0-3) | 5.3 | P<0.0001 | 3 (0-3) | 5.02 | P<0.0001 |
| procedure preparation | 4 (0-5) | 5 (1-5) | 3.6 | P<0.0001 | 5 (0-5) | 2.1 | P<0.0001 |
| Implantation procedure | 0 (0-5) | 5 (0-5) | 5.8 | P<0.0001 | 3(0-5) | 4.9 | P<0.0001 |
| Post-procedure care | 2 (0-4) | 5 (1-5) | 6.1 | P<0.0001 | 4 (0-5) | 5.8 | P<0.0001 |
| Pacemaker precautions | 4 (0-5) | 5 (1-5) | 3.6 | P<0.0001 | 5 (0-5) | 2.1 | P<0.0001 |
| Movement and activity daily living | 2 (0-6) | 7 (1-7) | 6 | P<0.0001 | 6 (1-7) | 5.9 | P<0.0001 |
| Medication and follow up | 1.5 (0-11) | 10 (0-14) | 6.02 | P<0.0001 | 9 (0-11) | 5.9 | P<0.0001 |

**$Z_1$is a comparison between the baseline and immediate post-program implementation, while $Z_2$ is the comparison between the baseline and after four weeks of program implementation.*

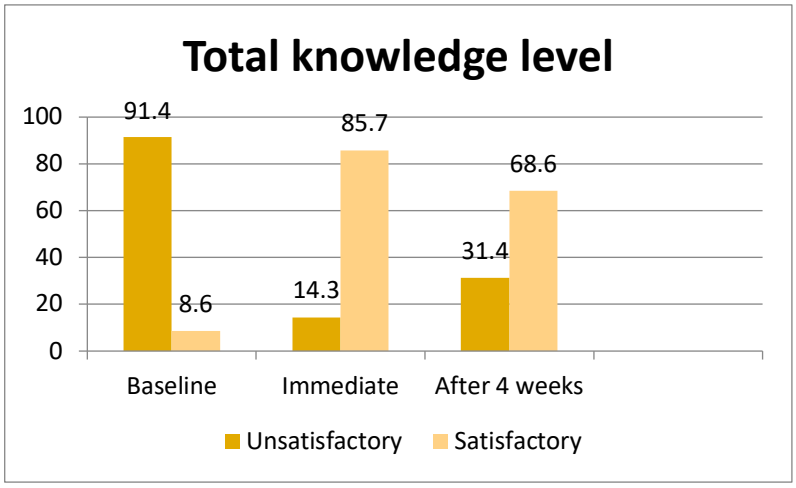


**Figure (2): Percentage distribution of total knowledge scores throughout the program implementation phases (no=35).**

**Table (3): Comparison of patients' practice through the program implementation phases (no=35).**

| Parameters | Baseline Median (Min-Max) | Immediate Median (Min-Max) | Z* test$_1$ | $P_1$ | After 4weeks Median (Min-Max) | Z test$_2$ | $P_2$ |
|---|---|---|---|---|---|---|---|
| Radial pulse measuring | 0 (0-6) | 6 (0-7) | 6.1 | P< 0.0001 | 6 (3-7) | 6.2 | P< 0.0001 |
| Wound care | 8 (1-11) | 10 (4-12) | 3.6 | P< 0.0001 | 11 (4-11) | 4.1 | P< 0.0001 |
| Total practice | 8 (1-17) | 16 (4-19) | 5.6 | P< 0.0001 | 16(7-18) | 4.9 | P< 0.0001 |

**$Z_1$is a comparison between the baseline and immediate post-program implementation, while $Z_2$ is the comparison between the baseline and after four weeks of program implementation.*

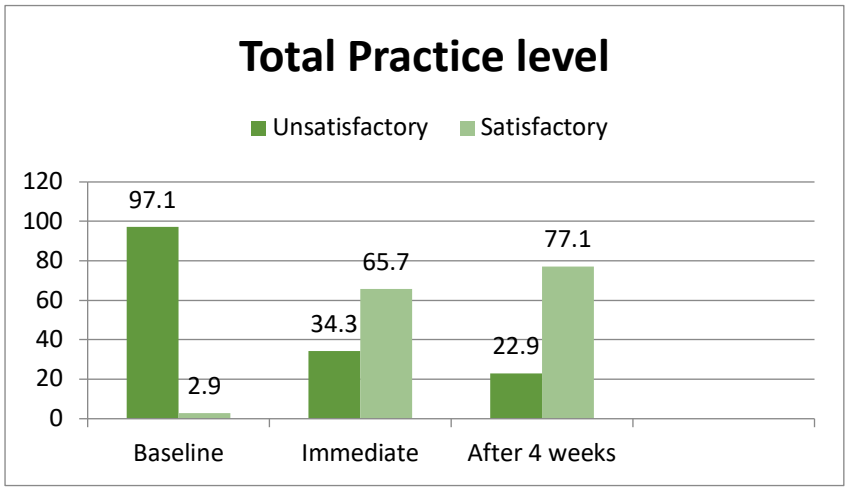


**Figure (3): Percentage distribution of total practice scores throughout the program implementation phases.**

**Table (4): Correlation between the total knowledge and practice level throughout the program implementation phases.**

| Variables | Total knowledge score | | | | | |
|---|---|---|---|---|---|---|
| | Baseline | | Immediate | | After 4weeks | |
| | r | p | r | p | r | p |
| Total Practice score | 0.2 | 0.2 | 0.3 | 0.2 | 0.4 | 0.004 |

**Table (5): Comparison of studied patients' self-efficacy throughout the program implementation phases (no=35).**

| Self-efficacy items | Pre | | Post | | $X^{2*}_1$ | $P_1$ | Follow-up | | $X^2_2$ | $P_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | | | No | % | | |
| **Control symptoms** | | | | | | | | | | |
| Not at all confident | 25 | 71.4 | 16 | 45.7 | 25.185 | <0.001 | 5 | 14.3 | 32.348 | <0.001 |
| Moderately confident | 8 | 22.9 | 12 | 34.3 | | | 14 | 40 | | |
| Very confident | 2 | 5.7 | 7 | 20.0 | | | 16 | 45.7 | | |
| **Maintain usual functions** | | | | | | | | | | |
| Not at all confident | 30 | 85.7 | 17 | 48.6 | 19.688 | <0.001 | 10 | 28.6 | 41.112 | <0.001 |
| Moderately confident | 5 | 14.3 | 12 | 34.3 | | | 16 | 45.7 | | |
| Very confident | 0.0 | 0.0 | 6 | 17.1 | | | 9 | 25.7 | | |
| **Total self-efficacy** | | | | | | | | | | |
| Low self-efficacy | 32 | 91.4 | 18 | 51.4 | 22.158 | <0.001 | 10 | 34.3 | 36.123 | <0.001 |
| High self-efficacy | 3 | 8.6 | 17 | 48.6 | | | 25 | 65.7 | | |

**$P_1$ (Between pre and posttest) $P_2$ (Between post and follow up test)*

**Table (6): Comparison of total anxiety and depression levels throughout the program implementation phases (no=35).**

| Anxiety and Depression level | Pre | | Post | | $X^{2*}_1$ | $P_1$ | Follow up | | $X^2_2$ | $P_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | | | No | % | | |
| Mild | 4 | 11.4 | 23 | 65.7 | | | 26 | 74.3 | | |
| Moderate | 11 | 31.4 | 8 | 22.9 | 24.5 | <0.001 | 5 | 14.3 | 54.351 | 0.001 |
| Severe | 20 | 57.1 | 4 | 11.4 | | | 4 | 11.4 | | |

**$P_1$ (between pre and posttest) $P_2$ (between post and follow up test).*

## 6. Discussion

A permanent pacemaker can significantly improve quality of life, and for several people, it can be lifesaving and preventing death. After a permanent pacemaker insertion, the optimal outcome could be obtained if patients are supported in compliance with a lifelong adaptation with a permanent pacemaker *(Timby & Smith, 2019).* The current study aimed to evaluate the effect of an educational program on outcomes of patients undergoing permanent pacemakers' implantation.

The present study indicated that around half of the study sample ages ranged from 40 to <50 years. This finding may be due to recurrent exposure to life stressors and responsibility, which is agreed with *Elsayed et al. (2015),* who reported that most study sample ages ranged between 40 to 50 years. This finding is also consistent with (*Kirkpatrick et al., 2015),* who reported a significant rise in permanent pacemaker implantation incidence after 40 years. *Ibrahim et al. (2010)* reported that although pacemaker is implanted in individuals of all ages, most of the patients frequently utilized it in older adults. This finding is owing to an increase in abnormalities of impulse generation and conduction among advancing age.

About gender, the present results showed that nearly two-thirds of the study sample were males. This finding might shed light on the gender difference in heart disease as recent clinical and experimental studies suggest that these differences may stem in part from fundamental intrinsic gender differences in cardiac tissue *(Di Diego, 2001; Fish & Antzelevitch, 2003; Xiao et al., 2006; Pham et al., 2002; Pham & Rosen, 2002; Gowda et al., 2004)*. These include intrinsic electrical differences resulting from variable ion channel expression and diverse sex hormonal regulations via long-term genomic and acute nongenomic pathways *(Xiao et al., 2006; Bai et al., 2005; Furukawa & Kurokawa, 2007; Korte et al., 2005; Nakagawa et al., 2005).*

This finding agreed with *Elsayed et al. (2015); Kramer et al. (2015),* who found that the incidence of a permanent pacemaker in males was 1.5 times that in females. These findings contradict that of *Newall et al. (2007); Wojcicka et al. (2018),* who reported that permanent pacemakers are most commonly implanted for older patients above the age of 60, plus nearly about half of the patients in his study were females.

Concerning marital status, the results revealed that most of the patients under the study were married. This finding might be because married people were liable to cardiac diseases more than single. After all, they always face the psychological stressors of their social role. This result was supported by the *American Heart Association (2018)*, which stated that marriage increases the patients' responsibility regarding the family and children. Also, it increases the stressors. This finding goes in the same line with *Elsayed et al. (2015),* who found that most of their study sample were married. This finding was also congruent with *Pederson et al. (2019); Rahmawati et al. (2017).*

About education, the present results show that half of the patient had secondary education and one-third of them can just read and write, around two-thirds of them residing

in the rural areas, had labor work with inadequate monthly income, suffering high transportation costs, and treated by health insurance and ministerial decree. This finding could reflect the patients' socioeconomic standard in the area served by the study setting, with the unavailability of specialized hospitals affording pacemaker insertion in rural areas, so the patients have to be transported to the central city for seeking the proper treatment. Almost similar findings revealed by *Elsayed et al. (2015); Hossein et al. (2010),* who reported illiteracy among half of their study subjects, in addition to two-third of them were residing in a rural area. They also reported that more than three-quarters of the patients under study had insufficient monthly income for treatment costs and the majority of them complained from transportation and high medication costs. Moreover, healthcare expenditure could be a significant portion of living fixed costs for patients suffering from cardiac diseases *(Bailey & Wilkoff, 2006).*

As regards having coexisting diseases, the present study reveals that less than one-fifth of the studied patients had associate cardiac diseases other than conduction disturbances, in addition to other chronic diseases such as hypertension, with a minor percentage suffer diabetes mellitus, kidney and liver diseases, which may accelerate the complications in those patients. These findings agree with *Elsayed et al. (2015); Hossein et al. (2010),* who reported that the minorities of patients have associate chronic diseases.

Regarding patients' knowledge, the current study demonstrates that most of the studied patients reveal the unsatisfactory level of total knowledge at the baseline assessment improved to a satisfactory level immediately and after program implementation and relatively maintained at the follow-up phase with a statistically significant improvement regarding all knowledge elements. This finding might be referred to as the meaningful, relating, precise, and detailed information given to them during the program sessions that directly touch their needs. Also, the interest of the study subjects to know how to deal with the permanent pacemaker.

*Stewart and Sheehan (1991)* clarified a poor patients' knowledge before the educational program as most of their patients reported that the nurses were not explaining instructions to be followed. Most of them did not obtain information regarding precautions related to a permanent pacemaker. These findings are in agreement with *Tagney (2010); Hossein et al. (2010); Malm et al. (2017),* who demonstrated a strong, as well as regular improvement of knowledge level after the education program as more than half of their study sample, increased to ninety percent and eight-nine percent, at pre, post-education program and at follow up respectively had a satisfactory knowledge.

Moreover, *Faltas (2017)* mentioned that the patients were positively affected by the written information specified. The patients who received the booklet had increased knowledge and were more satisfied with information concerning their diagnosis than the control group. *Orly and Orna (2018)* found that the level of knowledge was low before the education session, which was higher after the sessions. Knowledge levels increased in all patients, young and old, and they stated that the patient who obtains knowledge had an active life after permanent pacemaker implantation.

Regarding patient's practice, the results of the present study show that most patients had unsatisfactory practice regarding the two necessary procedures of redial pulse measuring as well as wound care, which improved to around three-quarters of them had a satisfactory practice at immediate and the follow-up phase with a statistically significant improvement in both procedures and the total. This finding might be referred to as the lack of standardized nursing care for those patients or an education program applied in the study setting. This improvement may be due to continuous demonstration and re-demonstration throughout the program sessions, the valuable content plus the illustrated instructional booklet with pictures, and the patient's motivation to monitor and care for themselves. This finding is supported by *Metwally (2010); Hussein (2014),* who reported a statistically significant improvement in patients' performance immediately after the education program and at follow up.

Moreover, *Mohamed (2009); Ammirati et al. (2001)* found an improvement level of the study group practice score post-implementation of education program compared to the control group with highly statistically differences post-implementation and follow up assessment. Also, *Aggarwal (2018); Ahmed (2019)* found a significant improvement in patients' practice after the educational program. This result disagrees with *Elsayed (2015),* who found that about half of the study sample never do wound dressing daily; this may be owing to inadequate instructions regarding wound care and complication prevention; besides, the inadequacy of income to buy dressing supplies. Additionally, *Marzouk (2018)* reported that more than half of the sample was never following precautions to care for the wound. These findings are supporting the first research hypothesis.

The current study reveals a statistically significant positive correlation between the studied patients' total knowledge and total practice score after four program implementation weeks. This finding may be referred to as the improved patients' knowledge was a critical factor in enhancing the patients' practice after implementing the education program. This finding is following *Allen and Oliveira (2009),* who stated a significant improvement in patients' knowledge plus practice following using education programs that strengthen and update their patients' knowledge and improve their quality of life after pacemaker implantation.

Also, *Andrew (2018)* agreed with this finding. He studied the "Influence of written information on patient's knowledge of their diagnosis" on 64 patients at Oxford University and found that patients receiving an information sheet had increased knowledge along with practice regarding previous medical problems. Likewise, the previous result was supported by *Coronary Heart Disease Team (2019)*, which emphasize that educational program always keeps and, maintain the patients' speed and efficiency in carrying out their respective activities and so the quality of life will

be improved. In this regard, *Ackly and Fuster (2017)* stated that the patients who are oriented to everything related to their disease are more likely to engage in activities that promote changing their behaviors and promote physical wellbeing than those who are not.

A variety of evidence indicates that educational attainment is associated with better outcomes in patients with implanted permanent pacemakers *(Hossein et al., 2010; Kajanova et al., 2014).* This finding was the case in the current study, as it reveals a significant improvement in self-efficacy. A highly statistically significant difference was found between the post and follow up tests scores of the two self-efficacy sub-scales (controlling symptoms and maintaining usual functions) and the total.

Regarding the control symptoms subscale of patients' self-efficacy, it was observed that the most significant improvement was in the follow-up period, where nearly half of the patients were very confident to control symptoms like dizziness, fainting, palpitation, trouble catching breath, and hiccups that last more than 15 minutes, chest pain, chills, and fever. This finding was supported by *Assadi and Alange (2016); Boroumand et al. (2015),* who stated that patients with a permanent pacemaker would require more information regarding nonmedical techniques to deal with annoying symptoms.

Concerning the maintaining usual functions subscale of patients' self-efficacy, it was detected that the follow-up test showed the most vital functional ability as compared to the pre and posttests. Despite that, about one-fourth of the studied patients are still not confident at maintaining their usual functions. The total self-efficacy level shows a highly significant improvement at the follow-up test more than the post-test (about two-thirds of the patients showed high self-efficacy in the follow-up test compared to less than half in the post-test).

These findings can be interpreted as, in the follow-up period, the healing process became nearly completed, the programming of the device became settled, and patients became more familiar with the new living restrictions. Regarding some patients who still not confident to function well, this may be because they may still be anxious about their life, so they prefer not to do activities and keep resting. In congruence with this interpretation, *Wenwen et al. (2013)* stated that such patients need more support to return to their usual activity level and become independent gradually. Also, *Allahverdipour et al. (2013)* stated that educating patients with pacemakers helped improve their health status and quality of life and strengthen their self-efficacy perception.

Considering anxiety and depression levels among the studied patients with implantable pacemakers, the current study reveals a highly significant reduction in anxiety and depression levels in the post and follow-up tests compared to the pretest. A noticeable finding was that about two-thirds of the patients had mild anxiety and depression in the posttest. While in the follow-up period, about three-quarters of patients exhibit significantly better psychological status compared to their pretest.

This finding may be attributed to an educational program's effect on keeping patients in contact with the researchers. It may also be due to stressing interpersonal communication through group discussion, which made patients ventilate their feelings and had their questions asked to help them cope with their life transitions. *Cohen et al. (2012)* emphasize such interpretation that the promotion and maintenance of patients' social and mental health have been shown to have a positive impact on their overall health and wellbeing and play a significant role in decreasing anxiety and depression.

This result was supported by *Vellone et al. (2008); Lampert (2017),* who explained that knowing the details of a patient's abilities, difficulties, weaknesses, and strengths providing the bridge by which the patient's mental, physical and social needs are met. *Cheng et al. (2013)* had an incongruent finding. They found that poor psychological and physical wellbeing and high depression levels were somewhat greater in patients with pacemaker implantation even after the educational intervention. These findings are supporting the second research hypothesis.

## 7. Conclusion

Based on the results obtained above, the current study was supported the research hypotheses that post implementing the educational program, the patients' knowledge and practice score regarding permanently implanted pacemakers became higher than their pre-implementation scores. After implementing the educational program, patients' self-efficacy, anxiety, and depression were improved than their pre-implementation level.

## 8. Recommendations

The following recommendations were suggested:

- The educational program should be an integral part of the total management of patients undergoing permanently implanted pacemakers.
- A simplified and comprehensive booklet, including updated guidelines regarding pacemaker's management, should be introduced to all patients undergoing permanent pacemaker implantation at admission and should be clearly explained by photos for illiterate patients.
- Establishing a hotline contact for urgent physician consultations with patients with a permanent pacemaker should be an urgent need for those patients' groups.
- Periodically follow up schedules should be designed and emphasized for those patients in order to improve their compliance.
- Long term effects of the educational program should be further studied. Also, education is essential for nurses educating patients with implanted devices to play a successful role, so further researchers on the effect of nurses' education on patients' outcomes should be given a priority in teaching nurses.

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